Reliable high-powered marine solutions

Naval defense

MAN Energy Solutions
Future in the making

Four-stroke marine systems
Future in the making

MAN Energy Solutions is the world’s leading provider of large-bore diesel engines, turbomachinery, and integrated power systems. We make four-stroke and two-stroke engines for marine and stationary applications, turbochargers and propellers, gas and steam turbines, compressors and chemical reactors.

Our marine systems expertise is focused on emission reduction, complete propulsion packages, electrical propulsion, dual fuel, LNG, and digitized services.

We are the only manufacturer that serves to the whole spectrum of maritime defense applications: from fast patrol boats to large auxiliary ships, from offshore patrol vessels to submarines. No less than 59 navies rely on our engines to keep their naval vessels moving.
Specialized expertise for special situations

Security in changing times

The naval defense segment is growing in the face of national security concerns. At the same time, the growth of asymmetric threats and terrorism demands increasing maritime security.

Modern vessels fulfill an extremely broad and complex range of tasks. As long-term partners of the defense market, we are aware of the requirements and constraints of each application and can design a precisely tailored solution.

MAN systems perform in demanding conditions

Navies make special demands on our propulsion systems. Shockproof design, noise cancellation and invisible magnetic signatures are just some of our reliable and perfectly integrated solutions.
Four-stroke engines for naval defense

- **MAN 175D**
  - GenSet: 500 – 1,330 kW
  - Propulsion: 1,440 – 3,200 kW

- **MAN 32/44CR**
  - GenSet: 3,600 – 6,000 kW
  - Propulsion: 7,200 – 12,000 kW
  - 14,400 – 21,600 kW

- **MAN 28/33D STC**
  - Propulsion: 5,460 – 10,000 kW

- **MAN 48/60CR**
  - Propulsion: 7,200 – 10,800 kW
  - 14,400 – 21,600 kW
### Offshore patrol vessels

08 – 11
- **MAN V175D**
  - **GenSet**
  - 1,940 – 3,200 kW

12 – 15
- **MAN V175D**
  - **GenSet**
  - 1,940 – 3,200 kW

16 – 19
- **MAN L32/44CR**
  - **GenSet**
  - 3,600 – 6,000 kW

20 – 23
- **MAN V175D**
  - **GenSet**
  - 1,499 – 3,700 kW
- **MAN VP185**
  - **GenSet**
  - 2,000 – 4,000 kW

24 – 27
- **MAN P44**
  - 300 – 1,335 kW

### Naval combatants

12 – 15
- **MAN V175D**
  - **GenSet**
  - 1,940 – 3,200 kW

### Amphibious and support ships

16 – 19
- **MAN L32/44CR**
  - **GenSet**
  - 3,850 – 6,000 kW

20 – 23
- **MAN V175D**
  - **GenSet**
  - 1,499 – 3,700 kW
- **MAN VP185**
  - **GenSet**
  - 2,000 – 4,000 kW

### Inshore and fast patrol craft

20 – 23
- **MAN V175D**
  - **GenSet**
  - 1,499 – 3,700 kW

### Submarines

24 – 27
- **MAN PA4**
  - 300 – 1,335 kW

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**For a powerful response**

**Offshore patrol vessels**

Small and compact, but operating on the open sea, offshore patrol vessels take on a very broad range of missions that include search and rescue, maritime surveillance, environmental monitoring and fishery protection.

**Versatile performance**

While the engine load profile for a patrol boat has to be very flexible, it almost always has to deliver quick, high power response, endurance and faultless operation during any mission. Easy operation and maintainability is a must.

Our engine options also offer you freedom and flexibility of design, with solutions for both mechanical and hybrid electric propulsion.
Strength meets stealth

MAN 28/33D STC

Continuous low load operation capability and high torque for fast acceleration are just two of the features that make the MAN 28/33D STC perfectly suited to offshore action. This powerful engine builds on the heritage of the successful MAN PA6B.

Robust and reliable, not only does the MAN 28/33D STC offer strength and stealth for any mission, it also keeps downtime low for high availability. In mechanical propulsion systems, it gives you torque that is easy to control and optimal acceleration response.

Benefits

Economic operation
One of the lowest total cost of ownership (TCO) on the market

Low maintenance costs
Due to long time between overhaul (TBO) intervals and on-board maintenance

Best power-to-weight ratio
in its class
5.2 kg/kW, unequaled by any other medium speed engine

MAN 175D GenSet:
the perfect combination

With its continuous, reliable performance and state of the art technology, the MAN 175D GenSet allows you to focus entirely on your mission. Your crew don’t have to learn to use different systems: interface, maintenance procedures, and documentation are aligned and consistent.

Sequential turbocharging (STC)
Two identical yet independent turbochargers provide high torque at low rpm. Fuel injection quantity, rate, and timing are electronically controlled for perfect acceleration control.

Low acoustic and thermal signature
Especially suitable for naval applications. It is capable of extended operation at low loads with high efficiency and minimal heat dissipation.

Further power solutions
MAN 175D GenSet
MAN VP185
Always ready for action

**Naval combatants**

Corvettes, frigates and destroyers depend on high-powered, efficient engines that won’t let their crews down or risk the success of their missions – whether on far-from-home deployments or fast escort operations.

**Silent and swift**

Naval combatant applications usually require high speed for fast escort operations, without having to compromise on acoustic, thermal, and visual signatures. They also have to withstand shocks or even be chemical, biological, radiological and nuclear capable (CBRN).

Our powerful and compact engines deliver this level of performance while ensuring maximum availability and outstanding specific fuel oil consumption (SFOC). Best-in-class life cycle costs are supported by our worldwide logistics service.
Maximum readiness

MAN 28/33D STC

With its compact design and powerful performance, the MAN 28/33D STC is perfect for military vessels. The powerful engine has a high power-to-weight ratio and is fully compliant with current environmental standards, producing NOx emissions that fulfill IMO Tier II and EPA Tier II requirements with internal measures only and IMO Tier III requirements with a combined selective catalytic reduction system (MAN SCR).

Maintenance costs are kept low thanks to high engine availability. And with main overhauls only necessary every 32,000 hours, servicing downtime is kept to a minimum. As a result, you can count on low overall operating costs and best-in-class SFOC.

Benefits

Best power-to-weight ratio
in its class
5.2 kg/kW, unequaled by any other medium speed engine

High reliability and low maintenance efforts
All maintenance in situ, no removal from vessel necessary, no change of crankshaft

Simple efficiency
Sequential turbocharging (STC) provides optimum matching over all loads with only two turbochargers

Noise and shock optimization
The acoustic propulsion module dramatically reduces airborne and structure-borne noise, and enhances safety – yet is easy to install, operate and maintain.

Military design
Developed in close cooperation with naval forces, the engine has a high power-to-weight ratio, all pumps are attached and all maintenance can be carried out on board by the crew.

Combat capable
The MAN 28/33D STC is built to withstand shocks and achieve enhanced noise emission levels when fitted with special elastic mountings. It is designed for CBRN operations.

Cooling system
The concept includes aligned cylinder units to minimize the installed weight. The intercooler assembly is centrally mounted, also contributing to the engine’s light weight.

Further power solutions
MAN 175D GenSet
Mastering complex challenges

Amphibious and support ships

Naval amphibious and support ships transport troops and supplies over long distances. Non-military deployment can be just as challenging. In disaster relief operations, the ships can act as hospitals, crisis management units, communications centers, or helicopter platforms.

High expectations

Great demands are made of amphibious and support ships, including a long operational life. Worldwide logistic support missions can be long in range and duration. The engines must offer ultimate shock resistance, silent operation, and low visual or infrared signatures. The large and complex propulsion systems have to deliver a high number of running hours and are expected to last for a very long time.

Offering reliable, high power operation at low fuel consumption, our engines pass the test in terms of reliability and economy. What is more, our systems include powerful generating sets for integrated electric and hybrid plants.
Robust and flexible

MAN 32/44CR

The development of the MAN 32/44CR has benefited from many years of experience of industrial-sized diesel engine architecture. It has proven itself in merchant navy applications and can provide a solid reference list. Its high reliability ensures a long TBO.

Benefits

- Highly efficient common rail technology
- Best-in-class SFOC
- Low operating costs
- Higher efficiency and improved maintainability
- Low exhaust emissions
- Complies with IMO Tier II and IMO Tier III (with optional MAN SCR)

Propulsion and auxiliary power in one

The MAN 32/44CR is designed as a multi-purpose drive. It can be used for mechanical or diesel-electric propulsion or for diesel-electric power generation. Using it as a marine main engine and auxiliary engine brings huge advantages in terms of operation and support.

- Common rail injection
  - Allows flexible setting of injection timing, duration and pressure. This flexibility allows the fuel consumption and emissions to be optimized based on its operating profile.
- High efficiency turbocharger
  - The use of MAN Energy Solutions turbochargers equipped with the latest high efficiency compressor wheels can alleviate the NOx-SFOC trade-off. The higher pressure ratio increases the efficiency of the engine and therefore compensates for the increase in SFOC normally associated with lower NOx emissions.

Further power solutions

MAN 32/44CR GenSet
MAN 48/60CR
Inshore and fast patrol craft cover a multitude of coastguard duties, including search and rescue, fire-fighting, environmental surveillance, border control, customs and police duties. In a military context, they can be deployed as littoral combat crafts, protecting infrastructure or in special operations.

Ease of use
Because they are deployed in coastal waters, engines for inshore patrol craft usually have very high emission compliance standards (IMO Tier III). In terms of performance, extremely fast response is a must in the majority of cases.

The typically small crews on these boats have their own specialized duties, such as rescue, inspection and combat. That means that simple engine operation and maintenance is essential.
When it comes to high speed diesel engines, the MAN VP185 has certainly proven itself in many applications. In terms of performance, it has one of the highest power densities on the market and full black start capability. At the same time, its operation is simple and reliable.

**Benefits**

**High speed availability**
Full rating available at 45°C ambient, 32°C seawater

**High power output**
Power-to-weight ratio is 2.69 – 2.88 kg/kW

**Low operating costs**
Thanks to ease of maintenance, low fuel consumption and low emissions

**Environmental compliance**
The high-performance MAN VP185 engine is IMO Tier III compliant when fitted with selective catalytic reduction (MAN SCR). The compact, modular system is the most tested and approved system for achieving NOx reduction rates of up to 90%.

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**Two-stage turbocharger**
Simple, two-stage turbocharging with no complex control or changeover valves provides a wide torque curve, making the MAN VP185 the ideal propulsion choice for high speed coastal patrol vessels.

**Combined charge air heater/aftercooler**
Provides optimized air manifold temperature for extended operation at low load without white smoke or maintenance impact.

**Water-cooled exhaust manifolds**
Provide a low surface skin temperature and low heat rejection into the engine room, offering an inherently safe and cooler operating environment.

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**Further power solutions**
MAN 175D
Submarines are, of course, very special. They have tasks such as surveillance and intelligence gathering; they may be used for the deployment or recovery of special operation teams; sometimes they are even armed with nuclear weapons.

Ensuring operational safety

A submarine’s engine is also special; it not only has to work underwater, it also has to be extremely quiet and free of vibrations, because stealth is paramount. Maximum engine safety and reliability are essential.

Drawing on our extensive understanding of the unique conditions faced by underwater craft, we have developed one of the most reliable submarine diesel engines in the world, capable of working under high exhaust back pressures and low suction pressures.
The MAN PA4 engine is the power source of choice for conventional submarines. Proof of our expertise is that MAN PA4 engines are installed on board nearly 100 submarines. The model that represents the very best in performance and power for diesel generators in submarine applications. Its unique supercharging system features an engine-driven compressor and exhaust-gas turbocharger. With its 90 degree V configuration, this 12-cylinder workhorse offers unrivaled power output in its class.

Benefits

“Variable geometry” combustion system
For low mechanical stress, low noise and low vibration emissions

Mechanically driven compressor
Safest submarine solution for producing energy with supercharged diesel engines

Black start capability
MAN PA4 is able to start without any electrical supply

Safe snorkeling
The greatest advantage of the MAN PA4 is its very low sensitivity to variation/deterioration in snorkeling conditions. Its proven design is recognized worldwide as representing the most reliable technology for total operational safety.

Supercharging system
Features an engine-driven compressor and exhaust-gas turbocharger. This system combines all the advantages of mechanically supercharged engines (e.g. insensitivity to suction and exhaust conditions) with all the benefits of conventional turbocharged engines (e.g. high power density).

Mechanically driven compressor
The safest solution in a submarine to produce energy with supercharged diesel engines is to use a suitably dimensioned mechanically driven compressor to adequately compensate for back pressure.

Turbocharger
Each compressor is fitted with a charge air intercooler so that, after compression, the charged air can recover after its specific gravity to ensure good combustion.

Further power solutions
MAN PA4 SMDS
Optimized propulsion solutions

More than an engine
MAN Energy Solutions has a strong track record in the engineering and servicing of complete propulsion packages (including main engines, electric motors and variable frequency drives, gearboxes, propellers, and propulsion control systems) for navies and coastguards across the globe. We know what you expect: high propulsion performance and operational flexibility with low hydroacoustics.

Highly efficient propellers
Our propellers can be found on many types of ships – from small coastal cutters or supply and inspection vessels to larger, more powerful OPVs, command support vessels, and frigates.

We offer propeller blades with conventional high-skew profiles for our four- and five-blade series (CPP/FPP), as well as propellers for a shaft power of up to 40 MW. Highly efficient Kappel designs with specially modified fin tips ensure low noise signatures. And this impressive portfolio of products also includes a variety of water-lubricated stern tube systems.

Benefits of a complete propulsion system
Together with our affiliates RENK (gearboxes) and AKA (hybrid propulsion systems), we can create complete solutions for the complex propulsion needs of large ships.

- MAN engines
  Reliable and high-powered
- RENK gearboxes
  Special navy design
- MAN ALPHA propellers
  Noise-optimized
- AKA hybrid systems
  Tailored to operational requirements
MAN PrimeServ

Service with passion

MAN PrimeServ is the dedicated MAN Energy Solutions service brand. Via a network of over 100 service centers worldwide, MAN PrimeServ provides 24/7 service across the globe. Our range of services includes technical support, consulting and OEM spares, as well as maintenance, repair and comprehensive individualized service plans.

MAN PrimeServ provides

- Prompt delivery of high-demand OEM spare parts within 24 hours
- Fast, reliable and competent customer support
- Individually tailored O&M contracts
- Ongoing training and qualification of operators and maintenance staff
- Global service, 24 hours a day, 365 days a year
- Diagnosis and troubleshooting with our high-performance online service
Worldwide service

We offer retrofitting and upgrade services to bring engines and turbochargers already in service up to the very latest standards of performance and efficiency.

Using the latest digital technology, we enable you to maximize the performance and availability of your MAN equipment by accessing real-time data analysis, remote support and rapid solutions. We also offer an extensive range of training courses at MAN PrimeServ academies around the world.

Armed forces must always be ready for action and so is our service team, offering continuous support, dedicated training and fast delivery of spare parts wherever your military operations take you.

For more information please visit www.man-es.com/primeserv
Get your engines started ...
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